

recent advances in the art of glass microbubble manufacture, it is now possible to form crush-resistant compositions using microbubbles having a bulk average liquid displacement specific gravity as low as 0.2 or even lower. Preferred bulk average liquid displacement specific gravity values for these bodies lie within the range of about 0.25 to 1.3, optimum results being obtainable within the range of about 0.3 to 1.2. Sandability of the final product becomes more difficult as the specific gravity of the microbubbles is increased. Thus microbubbles significantly above 1.6 specific gravity are not particularly desirable for use. Also, when microbubbles having a bulk average specific gravity significantly above 1.6 are used (and even when those much above 1.3 are used in some compositions), problems sometimes are encountered with respect to sagging of the jointing compound when applying it to unite wall panels. In addition, the mass becomes stiffer as microbubbles of higher and higher bulk average specific gravity are used. This is so because the binder consistency needed for microbubbles of higher specific gravity must be of higher viscosity and higher gel content in order to maintain the heavier microbubbles essentially uniformly distributed in suspension throughout the bulk of the liquid dispersed jointing compound.

The microbubbles must not contain any significant number of pores or openings through their outer skin into the space therewithin. Hollow unicellular microbubbles have been found to give best results; but satisfactory results may be obtained using multicellular microbubbles having a continuous external hole-free skin. Microbubbles satisfying the noted properties may be formed by using well-known teachings in the prior art. For example, clay microbubbles possessing the required properties may be formed by using blowing agents with clay particles and subjecting the same to heat in a stack. Techniques causing the formation of microbubbles containing a loosely held alkali content sufficient to react with the matrix adhesive portion of my jointing compound should not be used unless the resulting microbubble is treated to render it chemically inert to the matrix portion of the compound. A particularly preferred method of making microbubbles of satisfactory inert properties involves the steps of subjecting soda lime glass particles to carbon dioxide for absorption and thereafter passing the particles through a radiant heating zone where they reach sufficient temperatures to cause melting of the glass and simultaneous expansion of dissolved carbon dioxide so as to effect the formation of microbubbles while the particles are free falling.

Minute glass microbubbles of the aforescribed type are added in proper volume relationship to a liquid-dispersed matrix adhesive, as will be described, to provide a final product which, when properly diluted with volatile vehicle, exhibits a buttery consistency for easy application to drywall. This result would appear particularly surprising in view of the large volume of the microbubbles required in the composition. Microbubbles account for between 70% and 95%, preferably between 80% and 92% of the water displacement volume of the total solids in the composition. It, therefore, is of major importance, in order to achieve buttery consistency of the final composition, that the solids constituents other than the microbubbles exhibit a proper balance of properties when dispersed in organic vehicle and water. Whether dry or emulsified or dispersed in organic solvent and water, the matrix as a whole must not exhibit that degree of tackiness commonly associated with pressure-sensitive adhesive. This is vitally important inasmuch as troweling and spreading of the composition, as well as ease of sanding, would be impossible if the matrix portion exhibited high tack.

This matrix portion is non-rubbery, possessing little or no extensibility as a dry film. It in fact appears to be somewhat brittle when studied as a dry film. This feature may be of practical significance from the standpoint of contributing to ease of sandability. Surprisingly, the ma-

trix adhesive portion exhibits excellent adhesion to paper and gypsum drywall board when it is applied as part of my composition. It likewise possesses the property of adhering well to metals such as galvanized steel or aluminum, which metals are commonly employed for corner beads in the drywall industry.

Achievement of the required properties for the matrix portion of the jointing compound may be accomplished by using a blend of ingredients as hereinafter described, or by using other or equivalent ingredients or especially tailored ingredients which exhibit the combined properties discussed. An especially convenient way to achieve these properties, using conventional materials now on the market, is by blending together, in a manner hereinafter discussed, a non-hydrosettable mixture of ingredients including at least one film-forming thermoplastic organic resin which is at least in part water dispersible, plus at least one finely divided inorganic filler. The formulations are non-hydrosettable in that they do not set up by taking up water of crystallization. In preferred formulations, a mixture of organic materials is used including a water-insoluble water-dispersible thermoplastic organic resin, a water-soluble film-forming thermoplastic organic resin, and a water-dispersible non-film-forming organic polymer. Based on the total content of solids in the jointing compound, no more than about 20% thereof by volume should be accounted for by organic material; and preferably the volume of organic material is maintained between about 4 and 15% (or possibly lower than 10%) of total solids. As higher contents of organic film-forming resin are employed, sanding difficulty is increased. They tear rather than fragment, as is required for ease of sanding. However, at least 2% of film-forming resin by volume of total solids is usually employed. Of course, a variety of organic materials may be used effectively in my compound. Some illustrative ones are: vinyl acetate, vinyl chloride-vinylidene chloride copolymers, vinyl formvar, cellulosic resins, casein, starches, polyvinyl pyrrolidone, etc. Even an organic material such as glycerine may be employed, if desired, for plasticizing; but such an organic material should be used only with caution to avoid sanding problems.

While as little as 1% of the total volume of solids in the compound may consist of finely-divided inorganic filler (e.g., finely divided expanded perlite, asbestos, clays, pigments, etc.) it is generally preferable to employ somewhat greater amounts as an aid to gaining buttery consistency; but no more than about 15-16%, or possibly 25%, by volume should be employed.

In the following illustrative examples parts are by weight, with volume relationships also specified.

Example I

Formulation No.	1	2	3
Part A:			
Polyvinyl butyral	4.25	4.25	4.28
Polyvinyl alcohol	5.375	5.375	5.37
Soybean protein polymer	4.87	9.75	9.88
Sodium pentachlorophenate	.12	.625	.32
Morpholine	.60	1.25	.62
Monobasic sodium phosphate	1.00	1.00	-----
Finely divided water ground natural mica	5.00	5.00	-----
Xylol	12.875	12.875	12.86
Methyl pentynol	12.875	12.875	12.86
Water	94.700	113.00	113.81
Total parts	141.665	166.00	160.00
Part B:			
Part A mixture	141.665	166.00	160.00
Finely divided calcium carbonate (pigment size)	30.00	-----	-----
Finely divided silica flour (passing 400 mesh)	-----	30.00	30.00
Hollow glass microbubbles	175.00	289.47	130.00
Statistics:			
Diameter of hollow glass microbubbles in microns	5-150	5-150	5-150
Bulk average liquid displacement specific gravity	1.0	1.6	0.5-0.6
Volume of hollow glass microbubbles to total solids, percent	87	86	90.7
Volume of organic solids to total solids, percent	6	7.6	5.4
Volume of all finely divided inorganic powders to total solids, percent	7	6.4	3.9